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$$z=c\phi(y)+\frac{ay}{1-b}\log x+c_1\log x+c_2\,....(2),$$

noticing that $u=\log x$ and $v=\log y$.

Also solved by *G. B. M. ZERR*, *G. R. DEAN*, *L. C. WALKER*, and *J. SCHEFFER*.
Professor Walker should have been credited with a solution of Problem 148.

152. Proposed by **F. P. MATZ**, Sc. D., Ph. D., Professor of Mathematics and Astronomy in Defiance College, Defiance, Ohio.

Solve the differential equation, $e^x\left[\frac{dy}{dx}-y\log x\right]-a[\log x+1]=0$.

Solution by **BEULAH FRAIZER**, Sophomore Student, Missouri School of Mines, Rolla, Mo.

Dividing by e^x, $\frac{dy}{dx}-y\log x=ae^{-x}[\log x+1]$. The integrating factor is $e^{-\int\log x dx}=e^{+x(1-\log x)}=\frac{e^x}{x^x}$. Multiplying by this,

$$\frac{e^x}{x^x}\frac{dy}{dx}-\frac{y\log xe^x}{x^x}=a\frac{\log x+1}{x^x}y.$$

The left hand member is the derivative of $\frac{e^x}{x^x}y$. Hence we have

$$\frac{e^x}{x^x}y=a\int\frac{\log x+1}{x^x}dx=-ax^{-x}+c.$$

The solution is therefore, $y=\frac{cx^x-a}{e^x}$.

Also solved by *G. B. M. ZERR*, and *L. C. WALKER*.

153. Proposed by **J. SCHEFFER**, A. M., Hagerstown, Md.

Find the equation of the loxodromic curve on an oblate spheroid.

Solution by **G. B. M. ZERR**, A. M., Ph. D., Professor of Chemistry and Physics in The Temple College, Philadelphia, Pa.

Take the figure to Problem 95, Calculus, page 79, No. 3, Vol. VII. Let $AG=\theta$, $EP=x$, $CO=b$, $OB=a$, and $CG=$an elliptical arc; $\angle QPN=\beta$. Then

$$PN=xd\theta,\ QN=ds=\sqrt{\frac{a^2-e^2x^2}{a^2-x^2}}dx,\ \frac{PN}{QN}=\tan\beta.$$

$$\therefore d\theta=\frac{\tan\beta\sqrt{(a^2-e^2x^2)}dx}{x\sqrt{(a^2-x^2)}}.\quad \text{Let } x=\frac{a\cos\varphi}{\sqrt{(1-e^2\sin^2\varphi)}}.$$

$$\therefore d\theta=\frac{(1-e^2)\tan\beta d\varphi}{\cos\varphi\,(1-e^2\sin^2\varphi)}.\quad \text{Let } \sin\varphi=y.$$

$$\therefore d\theta=\frac{(1-e^2)\tan\beta dy}{(1-y^2)(1-e^2y^2)}.$$

$$\theta=\tfrac{1}{2}(1-e^2)\tan\beta\left(\log\frac{1+y}{1-y}+\frac{1}{e}\log\frac{1+ey}{1-ey}\right)+C.$$

$$\therefore\ \theta=\tfrac{1}{2}(1-e^2)\tan\beta\left(\log\frac{1+\sin\varphi}{1-\sin\varphi}+\frac{1}{e}\log\frac{1+e\sin\varphi}{1-e\sin\varphi}\right)+C$$

$$=(1-e^2)\tan\beta\left(\log\frac{\sqrt{(a^2-e^2x^2)}+\sqrt{(a^2-x^2)}}{x\sqrt{(1-e^2)}}\right.$$

$$\left.+\frac{1}{e}\log\frac{\sqrt{(a^2-e^2x^2)}+e\sqrt{(a^2-x^2)}}{a\sqrt{(1-e^2)}}\right)+C.$$

DICPHANTINE ANALYSIS.

92. Proposed by **M. A. GRUBER, A. M., War Department, Washington, D. C.**

Find the sides of integral right triangles when the difference of the legs is given.

II. Solution by the **PROPOSER.**

From $(2mn)^2+(m^2-n^2)=(m^2+n^2)^2$, the general formula for prime integral right triangles, we find the difference of the legs to be m^2-n^2-2mn, or $(m-n)^2-2n^2$, the difference of a square and two times a square. This difference in prime integral right triangles is a prime number of the form $8p\pm1$, or a product or square of such prime numbers. Mathematically speaking, there is an indefinite number of right triangles for each difference of legs.

The first 20 differences of legs of prime right triangles are 1, 7, 17, 23, 31, 41, 47, 49 $(=7^2)$, 71, 73, 79, 89, 97, 103, 113, 119 $(=7\times17)$, 127, 137, 151, and 161.

When the difference of the legs is 2, 3, 4, 5, 6, 8, etc., the sides of the triangles are 2, 3, 4, 5, 6, 8, etc., times the sides of triangles in which the difference of the legs is 1. A difference of 14 is 14 times the difference of 1, and 2 times the difference of 7. And so on for all multiple right triangles.

Put $m^2-n^2-2mn=\pm d$. Then $m^2-2mn+n^2=2n^2\pm d$, and $m=n\pm\sqrt{(2n^2\pm d)}$. As already shown, d=the difference of a square and two times a square. Therefore, put $d=2r^2-s^2$. We will now have to find n in terms of r and s, so that $\sqrt{[2n^2\pm(2r^2-s^2)]}$ becomes rational. This is done by forming a series of convergents with r and s in accordance with the convergents of $\sqrt{2}$. Hence the following:

$$\begin{array}{rccccl}
\sqrt{(2n^2\pm d)}=s, & 2r\pm s, & 4r\pm3s, & 10r\pm7s, & 24r\pm17s, & \text{etc.}\\
n=r, & r\pm s, & 3r\pm2s, & 7r\pm5s, & 17r\pm12s, & \text{etc.}\\
m=r\pm s, & 3r\pm2s, & 7r\pm5s, & 17r\pm12s, & 41r\pm29s, & \text{etc.}
\end{array}$$